EXECUTIVE SUMMARY

The Federal Aviation Administration's (FAA's) Office of Commercial Space Transportation (AST) is responsible for licensing launches of launch vehicles (LVs), reentries of reentry vehicles (RVs), and the operation of facilities that support these activities.[2] Issuing a license for one of these activities is considered a Federal action and is subject to review as required by the National Environmental Policy Act (NEPA) of 1969, as amended, 42 United States Code (U.S.C.) 4321 *et seq*. This Programmatic Environmental Impact Statement (PEIS) evaluates the potential environmental consequences of licensing horizontal launches, reentries, and the operation of facilities associated with those activities. This PEIS is intended to be used to tier subsequent environmental analyses for site-specific launches, reentries, or the operation of a launch or reentry site. Licensing these activities would allow the space launch industry to meet demand for existing services and expand into new markets. Over the past few years, the commercial space industry has developed vehicles that launch and land horizontally from and on conventional runways. These vehicles could carry human passengers (i.e., spaceflight participants), cargo, or satellites.

This PEIS covers licensed launches from both existing government launch and reentry facilities and nonfederal launch and reentry sites in the United States (U.S.) and abroad. This PEIS assesses the potential programmatic environmental effects of licensing horizontal launches of LVs, reentries of RVs, as well as licensing the operation of facilities that support these activities. The operation, maintenance, repair, and decommissioning of payloads are outside the scope of this PEIS. The scope of the analyses contained in this PEIS is limited to the assessment of environmental consequences associated with the proposed action and alternatives at a programmatic level. The information in this PEIS is not intended to address all site-specific impacts. Any required site-specific environmental documentation would be developed as needed and tiered from this and other programmatic analyses as appropriate. Localized effects and the cumulative impact of these localized effects at an individual launch site can only be appropriately analyzed during the environmental review phase of the FAA's license application review process. Licensees are expected to comply with all applicable Federal, state, and local laws and regulations and international treaties. To facilitate the site-specific environmental analyses that would be required, the FAA has provided guidance throughout this PEIS in various sections and in technical appendices.

ES.1 Proposed Action and Alternatives Including the No Action Alternative

This PEIS analyzes the environmental impacts of the proposed action, three alternatives, and the no action alternative, as presented below.

- **Proposed Action** – The FAA would review applications and issue commercial licenses for: launches of horizontal LVs (1,279 horizontally launched LVs between 2005 and 2015 with a maximum of 154 launches per year), reentries of RVs with both powered and unpowered

[2] Launch vehicles (LVs) in this Programmatic Environmental Impact Statement are comprised of both expendable launch vehicles (ELVs) that have stages or components that are not intended for recovery or reuse, and reusable launch vehicles (RLVs) that have stages or components that can return to Earth and be recovered and reused.

landings (51 reentries between 2005 and 2015 with a maximum of 15 reentries per year), and the operation of facilities that support these activities.

- **Alternative 1** – Same as proposed action except that all reentries of RVs would have unpowered landings.
- **Alternative 2** – Same as proposed action except that all reentries of RVs would have powered landings.
- **Alternative 3** – Same as proposed action except that FAA would only license horizontal launches of LVs that ignite their rocket motors at or above 914 meters (3,000 feet).[3]
- **No Action Alterative** – The FAA would not issue commercial licenses for horizontal launches of LVs, reentry of RVs, or the operation of facilities that support these activities.

The proposed action and alternatives considered in this PEIS include three horizontal launch vehicle (LV) concepts, which include existing and conceptual designs. These LVs would typically range from 9 to 21 meters (30 to 70 feet) in length and weigh 1,300 to 4,500 kilograms (2,866 to 9,921 pounds) unfueled. The LV concepts, which are categorized by launch method, would use the following design configurations to meet operational goals.

- **Concept 1 vehicles** – These vehicles use jet powered take off with subsequent rocket engine ignition and powered horizontal landing.
- **Concept 2 vehicles** – These vehicles use rocket powered take off and flight and non-powered horizontal landing.
- **Concept 3 vehicles** – These vehicles are carried aloft by assist aircraft with subsequent rocket engine ignition and non-powered horizontal landing.

LVs may be launched on orbital or suborbital trajectories. Vehicles launched on suborbital trajectories would not reach orbit. Launches of LVs on suborbital trajectories would not require a reentry license. Vehicles launched on orbital trajectories would reach Earth orbit and would reenter the Earth's atmosphere. Launches of LVs on orbital trajectories that reenter would require a reentry license.

This PEIS analyzes environmental impacts by examining the following activities associated with the horizontal launch of an LV.

- Launch facility preparation
- Preparation of the LV
- Pre-flight ground operations
- Horizontal take off, flight, and/or launch
- Deployment of payload (if applicable) and/or attainment of intended altitude

This PEIS also assesses the impacts associated with the reentry of an RV, including

- Establishment of a reentry trajectory from Earth orbit or outer space,
- Reentry into the Earth's atmosphere,

[3] The altitude of 914 meters (3,000 feet) is generally accepted as the altitude of the mixing height. The mixing height is the level below which contributions of emissions can impact ambient air quality.

- Powered or unpowered landing, and
- Recovery of the RV from the surface of the Earth.

ES.2 Potential Impacts

Various environmental criteria were used to determine the overall environmental impact of the proposed action. Although the significance of most environmental consequences will need to be determined in a site-specific NEPA analysis that tiers from this PEIS, three resource areas may be affected on a programmatic level, these include: atmosphere, orbital debris, and socioeconomic impacts. This PEIS analyzes impacts on the atmosphere including: ambient air quality, acid rain, ozone depletion, and global warming. Impacts related to orbital debris include de-orbiting material as well as collisions in space with other man-made objects. Impacts associated with socioeconomics include the effects on the commercial launch industry and the national economy with respect to the global market; however, local socioeconomic impacts associated with developing a launch or reentry facility would be addressed in a site-specific NEPA analysis. The analysis contained in this PEIS is not site-specific; any required site-specific environmental documentation would be developed as needed and tiered from this and other NEPA analyses as appropriate.

Exhibit ES-1, Summary of Impacts by Alternative, lists the impacts by resource associated with the proposed action, alternative 1, alternative 2, alternative 3, and the no action alternative.

Exhibit ES-1. Summary of Impacts by Alternative

Resource Area	Proposed Action Impacts	Alternative 1 Impacts	Alternative 2 Impacts	Alternative 3 Impacts	No Action Impacts	Specific Regulatory Agency Consultation[4]
Atmosphere						
Troposphere	❍	❍	❍	❍	Δ	State environmental agency and Environmental Protection Agency
Stratosphere	❍	❍	❍	❍	Δ	
Mesosphere	❍	❍	❍	❍	Δ	
Ionosphere	❍	❍	❍	-	Δ	
Airspace[5]	❍	❍	❍	❍	Δ	FAA safety review and approval process
Biological Resources						
Vegetation[6]	❍	❍	❍	❍	Δ	N/A
Wildlife[5]	❍	❍	❍	❍	Δ	N/A
Threatened and Endangered Species[5]	❍	❍	❍	❍	Δ	U.S. Fish and Wildlife Service; National Marine Fisheries Service
Cultural Resources[7]	❍	❍	❍	❍	Δ	State Historic Preservation Officer; Tribal Historic Preservation Officer; National Register of Historic Places
Geology and Soils[6]	❍	❍	❍	❍	Δ	
Hazardous Materials and Waste[5]	❍	❍	❍	❍	Δ	N/A

Δ No change - No Impact ❍ Negligible Impact M Moderate Impact S Significant Impact

[4] See Appendix D for a detailed summary of the requirements for regulatory processes including information on agency consultation.
[5] The FAA license application process would minimize the potential impacts of the affected resource area, e.g., the Safety Review and Approval Process would address airspace.
[6] Potential impacts associated with the resource would be evaluated in a site-specific NEPA analysis.
[7] Launch or reentry activities would not result in a significant impact on the resource. The development of a new or modification of an existing launch or reentry facility would be analyzed in a site-specific NEPA analysis.

Exhibit ES-1. Summary of Impacts by Alternative

Resource Area	Proposed Action Impacts	Alternative 1 Impacts	Alternative 2 Impacts	Alternative 3 Impacts	No Action Impacts	Specific Regulatory Agency Consultation[4]
Health and Safety[4]	❍	❍	❍	❍	Δ	FAA Licensing and Safety Division Mission and Safety Review
Land Use						
Land Use[6]	❍	❍	❍	❍	Δ	U.S. Department of Agriculture Natural Resources Conservation Service
Section 4(f) Resources	❍	❍	❍	❍	Δ	Secretaries of the Interior, Housing and Urban Development, and Agriculture; state agencies
Socioeconomics						
Socioeconomics[5]	M	M	M	M	M	N/A
Environmental Justice[5]	❍	❍	❍	❍	Δ	N/A
Visual Resources and Aesthetics[6]	❍	❍	❍	❍	Δ	Appropriate Federal, state, and local agencies
Water Resources						
Freshwater and Marine Systems[6]	❍	❍	❍	❍	Δ	Local water agency (if a National Pollutant Discharge Elimination System permit or a Storm Water Pollution Prevention Plan is necessary)
Wetlands[6]	❍	❍	❍	❍	Δ	Army Corps of Engineers
Floodplains[6]	❍	❍	❍	❍	Δ	Federal Emergency Management Agency, Executive Order 11988
Ground Water[6]	❍	❍	❍	❍	Δ	N/A

Δ No change - No Impact ❍ Negligible Impact M Moderate Impact S Significant Impact

As shown in Exhibit ES-1, implementation of the proposed action or any of the alternatives other than the no action alternative would result in (1) impacts that would be negligible, (2) impacts that would be addressed through the completion of the FAA licensing process, (3) impacts that would require the completion of a site-specific NEPA analysis, and/or (4) impacts that would be negligible for horizontal launch or reentry activities, but would require the completion of site-specific NEPA analysis for the development or modification of a launch or reentry facility. The analysis contained in this PEIS concluded that the implementation of the proposed action or any of the alternatives other than the no action alternative would result in negligible impacts on all aspects of the atmosphere and on orbital debris. By adhering to the FAA licensing and review process, impacts on airspace and public health and safety would not be significant. Because this is a programmatic review, site-specific NEPA analysis would be required to evaluate the impacts on or associated with noise, vegetation, wildlife, threatened or endangered species, local socioeconomics, environmental justice, and hazardous waste. For licensing horizontal launch or reentry activities, the analysis contained in this PEIS found that the impacts on geology and soils, fresh water or marine systems, wetlands, floodplains, ground water, aesthetics and visual resources, section 4(f) resources, land use, or cultural resources would not be significant; however, these determinations depend on site-specific characteristics as well. The licensing of a launch or reentry site involving new construction or modification of existing infrastructure would require evaluation in a site-specific NEPA analysis.

Except for alternative 2, implementation of the proposed action would result in slightly greater environmental impacts than the overall impacts associated with the alternatives and no action alternative. Under alternative 2 it was assumed that all reentries would have powered landings; therefore, the environmental impacts of implementing alternative 2 would be slightly greater than those from the proposed action. However all impacts associated with the proposed action and the alternatives were found to be negligible. In terms of socioeconomics, the proposed action would result in the greatest beneficial impact as it would not restrict the innovation and development of the U.S. commercial space industry through restrictive licensing. Implementing the proposed action would not limit or restrict the growth of the U.S. space industry, while implementation of one of the alternatives could limit U.S. commercial launch and reentry vehicle development and growth, and implementation of the no action alternative could severely limit and restrict the growth of the U.S. commercial space launch industry.